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LEARNING THROUGH LISTENING BY VISUALLY HANDICAPPED STUDENTS
A REVIEW OF RESEARCH

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INTRODUCTION

In the past decade interest in the use of listening as a mode of learning for the visually handicapped has become increasingly evident. This interest is primarily attributable to the steadily growing amounts of information which must be absorbed by children in various types of educational settings. Visually handicapped children are at a decided disadvantage when they are required to obtain this information through reading alone since braille reading is from one-fourth to one-third times as slow as print reading by sighted students and large type reading is little faster. Therefore, emphasis is now being placed on listening as a means of gaining more rapid access to the ever increasing amounts of information which must be imparted to these students.

It is the purpose of this paper to review the literature related to learning through listening by the visually handicapped in an effort to determine the exact status of knowledge in this area and, hopefully, to identify specific areas in which additional research is needed. It should be emphasized here that the research reviewed will be only that which is primarily related to learning through listening. Studies related to auditory discrimination and auditory perception will not be included although many such studies exist. Since a review of this magnitude was not feasible at this time, it was determined that knowledge related to learning through listening would be more relevant to the needs of educators of visually handicapped children. Literature related to learning through listening by sighted students is reviewed only as it applies to the studies of visually handicapped students which are included in the paper.

PROCEDURE

As stated above, the major objective of this study was to review the research related to learning through listening by visually handicapped students in an attempt to assess the current status of knowledge in this area and to identify specific areas in which further study is needed. The procedure was essentially that of a thorough review of literature related to learning through listening by the visually handicapped. An initial bibliography was compiled and an attempt was made to determine whether there appeared to be a consistent pattern or organization in the research. A study of the bibliography revealed that the studies did seem to fall within three broad categories: (1) studies related exclusively to visually handicapped students, (2) studies related to a comparison of visually handicapped and sighted students, and (3) studies related to compressed speech.

This paper includes reviews of research in the first category only: studies related exclusively to visually handicapped students. Basically, these are studies in which only visually handicapped subjects participated. References are made to performances by sighted students, but these students did not participate in the studies cited. Studies in categories two and three will be reviewed in subsequent papers.

PARTIAL REVIEWS OF RESEARCH

In the process of reviewing the literature in this area, several partial reviews of research were identified. These reviews were compiled for specific purposes and were not intended as comprehensive reviews of research on learning through listening for the visually handicapped. They

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are cited here as sources of information in the specific areas to which they are directed. Studies reviewed will not be described in detail here since they will be included in subsequent sections of this paper.

Nolan, C.Y., The visually impaired. In Kirk, S.A., and Weiner, B. (Eds.), Behavioral research on exceptional children. Washington, D.C.: Council for Exceptional Children, 1963. Pp. 115-154

Nolan (1963) reviewed research on braille readers and large type readers in the areas of sensory and perceptual factors, educational media, intelligence and its measurement, educational development and its measurement, personality and social development and their measurement, and physical development and its measurement.

Studies reviewed which are directly related to learning through listening are those by Seashore and Ling (1918) comparing blind and seeing groups for auditory, tactual, and kinesthetic sensitivity; Axelrod (1959) comparing the performance of early-blind, late-blind, and seeing children on simple and complex tactile and auditory tasks; Enc and Stolurow (1960) comparing the effects of two recording speeds on learning; and Hayes (1938) studying the efficiency of blind children in understanding words.

Nolan, C.Y., Auditory communication in the education of the blind. In American Association of Instructors of the Blind, Proceedings of the 46th meeting of the American Association of Instructors of the Blind. St. Louis, Mo.: American Association of Instructors of the Blind, 1962. Pp. 39-43.

In the Proceedings of the American Association of Educators of the Blind, Nolan (1962) reviewed research in the auditory communication of the blind. He cited studies of listening ability of both blind and seeing students with a special emphasis on the medium of compressed speech. He also reviews studies related to specific variables realted to listening such as intelligence, difficulty of material, length of material, certain

types of mental functioning, grade level, M.A., etc. He then discusses studies related to the upper limits of rapid speech, studies comparing listening at normal rates with listening at rapid rates and studies comparing listening and reading.

Nolan concludes that the variables which effect the relative efficiency of comprehension (learning) by reading and listening are much the same as those related to listening comprehension (learning) itself. He states that these variables will also be related to comprehension of speed speech as compared with that of braille reading and they they must be taken into account in any research planned in this area.

In relation to problems to be considered for research, Nolan states that no information is available concerning the relative amounts of fatigue induced by reading and listening. He feels that this is critical factor which must be considered even if the efficiency of listening is greater than that of reading.

Nolan, C.Y., Audio materials for the blind. Audio-Visual Instruction, 1966, 11, 724-726.

Nolan (1966) also briefly reviews research in listening comprehension in an article concerned with audio materials for the blind. He cites results of studies on the relative efficiency of reading and listening for the visually handicapped which were conducted at the American Printing House for the Blind which conclusively proved listening to be the most efficient means of learning. These studies are reviewed in detail in another section of this paper. Nolan also reports on technical research in the use of audio materials and describes improvements made and planned for recording equipment.

Morris, J.E., Relative efficiency of reading and listening for braille and large type readers. In American Association of Instructors of the Blind, 48th Biennial Conference. Washington, D.C.: American Association of Instructors of the Blind, 1966, 65-70.

Morris (1966) carefully reviewed a study designed to determine the relative efficiency of reading and listening by the blind which was conducted at the American Printing House for the Blind. The interim and final reports of this study are summarized in a subsequent section of this paper.

Nolan, C.Y., Listening and reading in learning. In E. Foulke (Ed.), Proceedings of the Louisville conference on time compressed speech. Louisville, Ky.: University of Louisville (Center for Rate Controlled Recordings), 1967. Pp 67-68.

Nolan, C.Y., Factors in listening comprehension. Unpublished report. Louisville, Ky.: American Printing House for the Blind, 1967.

Nolan, C.Y., A 1968 progress report on listening research at APH. Association for Education of the Visually Handicapped, 49th biennial conference. Toronto, Canada: Association for Education of the Visually Handicapped, 1968. Pp.61-68.

In the three articles listed above, Nolan describes research in listening conducted at the American Printing House for the Blind. Studies relevant to the topic of this paper are reviewed in detail in later sections.

Brothers, R.J., Learning through listening: A review of the relevant factors. New Outlook for the Blind, 1971, 65, 224-231. [also in New Beacon, 1971, 55, 310-315.]

Brothers (1971) reviewed relevant factors in learning through listening, citing research with both blind and seeing subjects. He reported studies related to listener characteristics and listening comprehension (visual acuity, IQ, age, grade, sex, and education). He also described studies related to outside influences on listening (presentation rate, environment, study models, stimulus format) and learning task (frame of reference, content of introduction, and interruption of message).

Brothers concludes that an underlying objective in most of the studies has been to encourage greater attention to the listening task. Efforts to achieve this objective were reported in the studies reviewed. These efforts have resulted in the manipulation of the stimulus format, the control of the listening environment, and the suggestion of specific learner behaviors to be used. Studies of the characteristics of the individual learner were noted since these characteristics influence our expectations regarding the students listening performance.

STUDIES RELATED EXCLUSIVELY TO VISUALLY HANDICAPPED STUDENTS

Research reported in this section is concerned with studies and reports which make no comparisons between visually handicapped and seeing students. As is true with other aspects of listening studies related to visually handicapped students, there are relatively few empirical studies to report. For this reason, brief reviews of programs designed to improve listening skills, as well as articles in educational journals relevant to listening for the visually handicapped, are also included.

The review of research in this section follows a roughly chronological order except in instances in which the continuity of a specific series of studies would be interrupted by strict adherence to a chronological sequence. Sub headings indicate the general topic of studies in each section. For each study the chronological age and/or grade level of the subjects is given prior to the discussion to enable those interested in studies related to a specific group to identify them quickly.

Studies Related to the Meaning of Words to the Visually Handicapped

Three studies concerned with the meaning of words to the visually handicapped are of interest here since learning through listening is directly related to the meanings students attach to words. Two of these studies involve a replication. The first of the replicated studies was conducted in 1932 and the second, was conducted in 1960.

Cutsforth, T.D., The unreality of words to the blind. Teachers Forum, May, 1932, 86-89.

Ages	-	9-21 yrs.
Grades	-	4-12 yrs.

Cutsforth's study was designed to investigate individual differences among visually handicapped students in the tendency toward verbal-mindedness and to compare differences between congenitally and adventitiously blind students. The method employed was a modified form of controlled association in which subjects responded to the name of an object with an attribute of that object. Forty words were used as stimuli. Words were selected which would offer the greatest possible range of sensory availability. Some like "star", were practically inaccessible, and others such as "milk", "orange", "pepper", were things experienced daily in terms of several sense modalities. Others were selected for the verbal jingle which they suggest, as in "snow-white", "rose-red".

The words were presented orally to each subject in an individual testing situation and subjects responded orally. The instructions consisted of saying, "There are lots of things you can say about everything. A man is short or tall, fat or slim, kind or mean. What would you say about thunder? What would you say about fly paper? What would you say about water? etc".

Responses were classified under nine headings. The first two consisted of visual attributes - first, color; and second, brightness or other visual characteristics not involving color. The third classification included taste and smell; the fourth, auditory terms; the fifth, abstract responses such as "nice", "pretty", "expensive", etc. The last four classifications were concerned with actual attributes - texture, size and shape, temperature and weight.

Results of the study revealed that of the 1560 responses made by all 39 subjects, 853 or 54% were visual qualities. As might be expected, the adventitious group gave relatively more visual responses than the congenital group, with visual words constituting 65% of the responses of the adventitious group and less than half of the responses of the congenital group (48.2%). In both groups color responses far outnumbered visual responses not involving color. The next largest classification was the tactual with texture being the largest subclassification. Taste, smell, and auditory responses were remarkably few.

In discussing these findings elsewhere, Cutsforth (1951) says, "A predisposition toward the unwarranted use of meaningless visual terminology demonstrates a strong tendency toward unreality in which valid relationships are utterly disregarded. The inevitable result is that nothing but incoherent and loose thinking is possible. Intellectually, the child is organized without reference either to himself or to his own experiential world. The seeing world with its visual concepts and values becomes the flimsy gossamer web out of which his intellectual fabric must be woven." Cutsforth (1951 p.69) lays most of the responsibility for this problem at the feet of educators of the visually handicapped.

Nolan, C.Y. On the unreality of words to the blind. New Outlook for the Blind, 1960, 54,100-102

Age

Controlled Association Group	9-16 years
Free Association Group	9-20 years

Grade

Controlled Association Group	4-9
Free Association Group	4-12

Since the findings by Cutsforth were based on a small number of subjects and since the possibility existed that educational methods might have changed in a period of thirty years, Nolan (1960) replicated the study in 1960. The procedure used was the same as that used by Cutsforth. Individual children were required to respond orally to thirty-nine stimulus words presented orally by the experimenter. A preliminary practice with ten obviously non-visual words was given. Instructions were idential to those given in the Cutsforth study.

In order to determine if the controlled association method significantly affected the outcome, the study was replicated using a free association technique. Here the instructions were: "There are lots of things you can say about everything. Now, when I say a word to you, I want you to say the first thing that pops into your mind."

Results were tabulated and two experimenters independently judged the number of visual responses given to each stimulus word. Perfect agreement on number of visual responses was obtained for 90% of the ten stimulus words. Differences among judgments for the remaining 10% were quite small.

Results of the Nolan study reveal that proportions of visual responses in both groups are much lower than those obtained by Cutsforth. Proportions of visual responses for both groups of the Nolan study were quite similar for most words. However, for some words, the controlled

association method appears to elicit more visual responses. Both groups were significantly different from Cutsforth's group in over-all amount of visual responses made.

Nolan added an additional dimension to his study. For four words of the study, free associations were available (Woodrow and Lowell, 1916) for 1000 sighted children. Comparison of proportions of visual responses to these four words made by sighted children, visually handicapped children from Cutsforth's study, and the two groups in the Nolan study were made. These comparisons indicated that the children in the Nolan study closely resemble normally sighted children in amount of visual response to the four stimulus words while responses of the children in the Cutsforth study were quite different from the other three groups.

On the basis of this evidence, it appears that the visually handicapped students in the latter study are not characterized by "verbal unreality" to the extent of Cutsforth's subjects. In fact, evidence from the responses to the four words indicates that their behavior corresponds to that of normally sighted students.

Hayes, S.P. Words are wise men's counters (Hobbes): How rich are the blind? *The Teachers Forum*, May, 1938, 94-103,108.

Ages

Terman English Vocabulary Group Test	10-23 up
Terman English Vocabulary Individual Test	8-21 up
Stanford Achievement	age not given

Grades

Stanford Achievement Test	4-9
Terman English Vocabulary Test	grade not given

Hayes (1938) also studies the meaning of words to the blind. In an attempt to determine whether the blind tend to use large words, or words which they do not understand, he used the Terman English Vocabulary Test and the Stanford Achievement Test-Word Meaning.

Hayes goes into some detail in describing the tests and the methods of administration. He states that the purposes of the studies were to determine whether compensation for a sense of inferiority due to blindness might predispose blind children to a conspicuous use of large words,and whether educational methods tend to distort their vocabulary by over emphasis on words based upon vision to the neglect of words which are closer to their actual experience with the world of objects.

Results indicated, among blind subjects in 13 residential schools, an inferiority in the understanding of words about equal to their educational retardation in early grades, with a progressively greater inferiority in later adolescence where longer words and specialized, abstract terms form a larger proportion of standard vocabularies. A careful inspection of the particular vocabularies used did not show a preponderence of purely visual terms which would make the tests unfair to blind students or lower their scores on the assumption of verbalism. Curves of results took the normal bell-shaped form with small numbers of very inferior and very superior subjects at extreme ends of the curves.

Hayes states that it is quite possible that some subjects who show great superiority may have specialized in "big words" as a form of compensation, but urges caution about unlimited use of this idea. He felt that it would be safer to assume that we are dealing with the "fallacy of the single case": conspicuous individuals with good native intelligence may be making the most of their linguistic abilities and by attracting attention to themselves may give us the impression that such a reaction is a common response to blindness. Results from these studies, however, seem to show that the average blind children could not make much of a display with difficult words because he does not know them when they appear in the tests.

Hayes goes on to explain ways teachers can assist blind children in the development of vocabulary which is meaningful.

Studies Related to Educational or Training Programs

Research reported in this section includes descriptions of educational and/or training programs which were a part of specific studies. In some cases results are confirmed empirically while others are simply descriptions of programs or techniques for improving listening skills.

Fraiberg, S., Smith, M., and Adelson, E. An educational program for blind infants. The Journal of Special Education, Summer, 1969, 121-139.

Age - Infants

Fraiberg (1969) and her associates reported an extensive and long range program of education for blind infants and their parents which includes all phases of child development. Several statements and observations pertaining to the development of skills and attitudes which have relevance to learning through listening are given below:

> When we learned through our study of blind babies how nonvisual experience can serve the binding of a baby and his human partners we were able to translate this knowledge into a body of useful information for our parents to help them find a tactile-auditory "language" which brought babies and their parents into human partnership. Of all the things we have done to promote the early development of blind babies we place greatest value on our work in promoting the love bonds between the baby and his parents. No educational strategies can succeed if a baby has not found meaning in his world through affectional ties to his parents. No toy will have value if the human figures in the baby's environment are not valued. No device will give meaning to sound if the human voice has not united sound with the totality of tactile intimacy, comfort, and pleasure that can only be provided by a human partner.

The first task with the parents of newborn blind babies is an answer to one of the first questions of the mother, "How will he know me?" The mothers were fascinated to learn that a baby who has known cuddling and physical closeness in the arms of his mother and father will show preference during the early weeks for the parent, would "know" them in this way and would, in fact, squirm in the arms of a stranger. We told the parents that a blind baby who is "talked to" a fair amount will begin to smile around the same stage that sighted babies do when he hears mother's or father's voice, and that we had seen this as a "special" smile which was often reserved just for mother or father.

In all this we stressed the importance of "learning to know" through tactile and auditory experience. We encouraged holding and talking to the baby during feeding and also creating "social" times of holding, singing and playing lap games as the baby's awake time increases. We weren't always sure how well depressed and anxious parents could carry out these suggestions but we needn't have worried. A blind baby, like all babies, has a hunger for experience. As the parents began to satisfy this hunger, the baby, of course, responded with the smiles, the cooing, and the churning of arms and legs which every parent responds to as the first demonstrations of love. And once the conditions had been set up which created a "dialogue" of signals and responses between the baby and his parents we knew we had achieved the first guarantees for the blind baby's development.

For some parents, our initial advice was not easy to follow. "To talk to the baby" is perfectly natural for some parents and completely alien to the style of others. There are parents who never "talked to" their sighted babies. Usually, the worst thing that happens to a sighted baby who isn't "talked to" is that he may be retarded somewhat in language development. But if the same parents are rearing a blind baby, they can cut off their baby from his primary source of "knowing" his parents and there is a danger that this improverishment of his world will result in gross retardation in all sectors of development.

At the beginning of our research, we had expected that sound would provide equivalence for vision in reaching and attaining objects. We expected that

> the patterns of reach and grasp that develop gradually over the first four to six months in the sighted child when eye and hand become progressively coordinated, could be duplicated in the blind child through coordination between ear and hand. We now know that for the totally blind baby, there is no adaptive substitution of sould for vision in intentional reaching until the last quarter of the first year. In our sample, the modal age for attainment of the object through directional reach and grasp by sound cue alone was 10-11 months. Eye-hand coordination in the sighted child forms a nucleus from which any patterns of infant learning and development evolve. If the corresponding patterns of ear-hand coordination do not occur until four to five months later in the blind child, one can readily see that this must have important effects on his subsequent development. Moreover, just as a sighted baby will be greatly retarded in achieving eye-hand coordination in the absence of adequate stimulation, so the blind infant will be unable to achieve ear-hand coordination at the predicted age without previous adequacy of stimulation and experience.
>
> In the sighted infant the coordination of vision and reaching takes place just under five months with early swiping motions at the object which is seen. In the blind infant the coordination of the schemas of sound and grasping may not occur until considerably later, at 10 or 11 months. In short, there is no early and immediate adaptive substitution of sound for vision. In the absence of vision, sound does not give directional cues for search for most of the first. And, equally significant, the sound of an object does not imply substantiality or "graspability" until the last quarter of the first year.

Blanchard, I., and Beard, A.B. A program in basic communication development for retarded blind children. Journal of Special Education, Spring, 1968, 337-340.

Ages - 10-19 years

This article describes a program in basic communication conducted by the authors. The program involved severely retarded blind children who had been institutionalized for most of their lives. None of the 20 students were able to communicate verbally at the beginning of the program.

The authors state that although blind people are believed to develop unusual keenness in their other senses to balance the sense that is absent this did not appear to be the case with these children. In fact, at the start of the program it appeared that, while the children's hearing and sense of smell had been over stimulated, their sense of taste, touch, balance, and muscle position had not been exercised.

The program used with these children included activities directed toward utilizing all the senses. It is described in some detail below and seems to have implications for the development of awareness of sound, including language, for all blind children functioning at this level.

> Simple activities appropriate to an infant in a crib or on the floor were begun at once. Parts of the children's bodies were touched and moved and named, always in a kind of spoken rhythm, sometimes with actual rhyme. The children were helped to tap and clap their hands, kick their feet, crane their necks, bend their bodies. Involuntary body weaving, habitual in blind children, was caught and tamed with the hope that the movement might be brought into the child's consciousness.
>
> Individual developmental training was provided for each child, using the actual objects and locations that he was likely to encounter in his daily activities. Pieces of furniture were identified by their position, touch, and name. Articles of clothing were similarly identified, then candy, crackers, etc. Always, the student attendant physically aided the child in touching the object to make the action strong and direct.
>
> Soft toys, like furry rabbits and puppies, were stroked, with the word stroke uttered softly by the student and prolonged with a downward inflection. Occassionally this vocalization stimulated small attempts at imitation from some of the children. Hands, legs, clothing were stroked to the same long str-o-o-oke. The long o was later repeated in the word no and contrasted with the vowel in yes. As words containing the long o came up in other activities, their vowels were prolonged and repeated:

toast, throw, cold, etc. Careful attention was paid to the children's manner of eating. (Teaching self-feeding was part of the general program for the children.) Since the organs of speech are also those of eating, it is imperative that these organs function smoothly in this capacity as well.

During the speech development periods, the student-therapist shaped and moved the children's lips and jaws manually, sometimes against determined resistance. All were astonished at the hardness of upper lips, and inability to purse and pucker them, in children who have not used them for speaking. These children have missed, too, the playful smacking and kissing that a normal part of living in a home with parents and brothers and sisters.

While the first attention to the vowel in stroke occurred almost by accident, the continued emphasis was purposeful. Shaping lips to pronounce o can be accomplished manually, and the children were stimulated by this process.

Physical activities were also included in the program.

The reactions of the children were unbelievably slow (delayed). After this discovery, fully ten seconds were allowed to elapse before a reaction was expected. Adult conversation not directed to the children's activities was ruled out during sessions, so the children could concentrate on listening to one thing at a time.

This concentrated listening led to tape recording the children's own sounds. Many of them could utter no sounds other than screaming or crying, so their screams and cries were recorded. There were plenty of cries to record during the first days of the program. It was exciting and encouraging to adults when the children, in obvious recognition, started, smiled and became alert to their own screams and cries when the tapes were played back to them. More cries, with adult imitation of the cries, and increasingly more pleasurable vocalizing, were recorded and listened to. It was good to observe that as the program progressed, there were fewer cries and more and more happy sounds.

Funnelling sounds to the blind child's ears was indicated. Instead of calling to him from a distance, the student held the child's head gently between his hands and spoke to him in a normal speaking voice, with his face close to the child's. Megaphones were devised from two hands, candy wrappers, etc. Sounds were directed first to one ear, then to the other, regardless of the child's preference if any was shown.

> Gradually, the conglomerate sounds of the hospital were isolated. At first, all but one or two of the children seemed unaware of everyday noises, not even responding to their own names when they were called to the dining room. Earphones were introduced and attention to spoken voices, environmental sounds, and music became more focused.
>
> In order that there be a semblance of objectivity in assessing a child's development in communication, a check sheet was devised. The items checked on the form and the time they were checked represent subjective observation on the part of individuals. The notation of dates when items are first observed gives a chronological record of the child's developing ability to communicate. The check sheet is also a rough guide to sequences that a child may be expected to follow. The check sheet has three categories:
>
> I. No speech, no sound
> II. Makes sound
> III. Recorded sound
>
> Items under each category indicate the level of the child's functioning in that category.
>
> In eight weeks none of the children actually learned to "talk," and only two of them learned to distinguish and use appropriately the vowels in no and yes, up and down. There was a definite improvement in the children's alertness to sound and movement, in their cooperation with dormitory routine, and in their associations with other children.
>
> The experience of learning was established for the children during individualized teaching sessions. It is felt that group activities may now be possible. The rewards of communication in group play are immediate, and the students and supervisors are hopeful about the further development of basic communication skills in these blind children.

Simpkins, K. An auditory training program for kindergarten through third grade. Education of the Visually Handicapped, October, 1971, 70-73

Ages - Kindergarten through 3rd. grade - CA not given

This study included a training program in the recognition and understanding of environmental sounds and language sounds. The purpose of the study was to determine whether greater understanding of environmental and language sounds could be taught. The author uses the term "auditory perception" to define the understanding of these two kinds of sounds.

She states that throughout the literature statements are made inferring that auditory perception can be taught, yet little evidence has been found to support this hypothesis. This study is an attempt to test that hypothesis.

The method used for the study was the compilation of a curriculum guide of auditory training activities by teachers at the Overbrook School for the Blind in Philadelphia. The activities were to be used in their classrooms. These activities were combined with activities found in the literature. It was felt that organizing this training could be an aid in developing more efficient use of "auditory perception" skills in these children. When it was discovered that activities at each grade level overlapped, the approach was changed to ability level, thereby crossing grade designations to reach any child at any level at which he was functioning.

Activities proceeded from the primary ability level which involved grosser discriminations, to the advanced level which involved finer, more detailed discriminations.

The project director, in cooperation with a consultant from Temple University, devised an assessment instrument using some items and ideas for items from the Vallett Developmental Survey of Basic Learning Abilities, The Illinois Test of Psycholinguistic Abilities, The Wepman Auditory Discrimination Test, and others, as well as many journal articles and teachers suggestions.

The assessment instrument for pre and post experimental results consisted of a tape recording following the outline developed by teachers in cooperation with the consultant. Each heading in the outline was covered by at least three items representing gross, fine, and finest levels of perception. It was created especially for students at Overbrook School

for the Blind and utilized environmental sounds familiar to these students particularly. The assessment instrument was tape recorded in order to keep it standardized for each child. It consisted of 54 items - 12 for environmental sounds and 45 for language perception. The pre-test was given to 14 randomly selected students from grades K - 3 and to 14 different randomly selected students for the posttest. The groups were considered equivalent since the teachers had identified children in each class at varying levels.

The program involved two 15 minute training periods a day. These periods consisted of group activity training in auditory perception of environmental and language sounds. Results yielded some information which may support the contention that audition (auditory perception) can be trained. Since the children involved were visually handicapped, audition (auditory perception) was the important avenue for gathering information from the environment and from people (language sounds). The pre-test showed that not all children were utilizing this sense adequately. The posttest showed a statistically significant change in the understanding of environmental sounds which would indicate that this aspect of auditory perception can be trained. Language perception did not yield a significant difference, but closely approached it, which would indicate that with a longer training period or, perhaps, more emphasis, the ability to meaningfully understand language could be improved.

Stocker, C.S. Listening education: From the Kansas Project. New Outlook for the Blind, October, 1971, 265-270.

Ages - high school or older

This paper describes the program of study resulting from a three year project on listening education conducted at the Kansas Rehabilitation

Center for the Blind in Topeka (Stocker, 1970). All participants in the program were clients at the Rehabilitation Center and were high school age or older.

The basic listening program consisted of three 50 minute class periods per week for seventeen weeks. Instruction was divided into three phases: pre-skills or listening readiness, development of listening skills, and development of recall and retention through the techniques of review.

Specific goals of the first phase of instruction, listening readiness, were the discrimination of like and different sounds; unlearning rote listening by eliminating the retention of irrelevant words and sounds; and greater use of the other senses in listening and retention. Lessons included the use of sounds, music, work and task drills, informal paragraphs, and stories. Much time was spent in introducing the individual to the use of mental imagery and organization to increase his ability to remember. Also in this phase a great deal of attention was given to the problem of "emotional filter", the selective deafness resulting from the over-stimulation of the brain by the emotions. Although these filters affect nearly everything we hear and make efficient listening extremely difficult, it is possible for an individual to become aware of the influence of the emotions and to learn to cope with them satisfactorily.

The second phase, development of listening skills, included (1) learning to "tune in" to instructions, general speech, and sounds as the first step in the listening process; (2) recognizing transitions and "tuning in" again through cue words, phrases, and sounds; (3) recognizing the concluding phrases of the listening process; (4) improving listening organization through the further development of mental imagery and pictures; (5) learning to reorient oneself to the mental picture through verbal,

non-verbal, and other sensory cues; and (6) recognizing personal emotional filters and learning to control their effects better.

While the approach in the first phase was to single out specific attributes of good and poor listening, each exercise in the second phase was designed to utilize the whole complex of skills necessary to efficient listening. An essential part of this strategy is that each individual must be tuned in to the whole group. For this reason, a group approach is preferred over an individual approach. Throughout the first two phases, each student was encouraged to analyze his own listening skills and to develop, with the help of the instructor, some insight regarding his strongest and weakest habits.

The third phase of the listening education program was devoted to the further development of the student's ability to recall and retain information that he had received orally. The skills learned in the first two phases of the program were refined and tested through more detailed sets of directions, news stories, informal paragraphs, etc. Immediate recall was tested after presentation of the material and retention of information was tested several times over a period of up to two weeks. In all of these longer and more detailed sequences of listening, the individual constantly reviewed what he had just heard, combining the general ideas to form an overall pattern from which specific facts could then be recalled.

The teaching manual (Stocker, 1973) for conducting a listening education program. which resulted from this program, reflects the fact that the progress of individual groups will vary widely. The exercises to be presented in each phase of the program. therefore, are of different lengths and no effort has been made to set up an hour-by-hour schedule for presenting the material.

Stocker states that formal evaluation of gains in listening

efficiency is available through the administration of the Brown-Carlson Listening Comprehension Test before and after the program. She further states that, looking at the entire picture of test samples, it is clear that, regardless of visual acuity, those who score lowest on the test at entry into the program make the greatest gains on the test after training. Those who score in the highest range initially do not show significant gains in the final test.

In conclusion, Stocker says that in the course of the three years of the project, it soon emerged from work with groups and with individuals that, without a doubt, the greatest inhibitor of improved listening efficiency is the emotional filter. Regardless of the test scores and intensive training in the various listening skills, both positive and negative filters continued to adversely influence listening efficiency. Many emotional filters act so automatically and completely that they can never be controlled, but others, if recognized and identified, can be watched for and eventually coped with. Those who were able to retain such insights and thereby become better listeners, did so by realizing that one listens with the total self and not just the ear and the brain. This basic truth concerning involvement of self must be recognized and dealt with on an individual basis while teaching listening as well as any other training offered to the human being.

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Bischoff, R.W. Improvement of listening comprehension in partially sighted students. Sight Saving Review, Fall, 1967, 161-164.

Grades - 4-9

This is one of the few studies dealing exclusively with partially sighted students and the only study located which dealt solely with the

listening comprehension of these students. It is a summary of a doctoral dissertation completed by Bischoff in 1967 (Bischoff, 1967). It also involves a training program in listening as did other studies included in this section.

Bischoff points out that partially sighted students have a marked disadvantage in reading, as do braille readers, although educators are not always aware of this fact. While braille reading rates range from 90 words per minute for high school students to 50 words per minute for fifth and sixth graders, the median reading rate for partially sighted students is about 100 words per minute, which is less than half the median speed for sighted students. This means that, to cover the same amount of reading material in any given selection, the partially sighted student must read from two to three times as long as his sighted peer. Since the typical rate for recordings by trained professional readers is 175 words per minute, Bischoff feels that the educational handicap placed on partially sighted students by the slow rate of print reading could be somewhat alleviated by training in listening comprehension. The purpose of the study described here was to test this hypothesis.

The study used two experimental groups and one control group. Sixty three subjects were included, fourteen from public schools and seven from residential schools.

The materials were listening comprehension lessons containing informative, factual, or enjoyable information for students. Sources were My Weekly Reader - Listening Comprehension Paragraphs, Common Sounds- Dr. R.D. Russell, and SRA - Listening Skill Builders. Two listening sequences were developed from this material. Both sequences contained an introductory lesson followed by 19 lessons of 15 minutes each. All lessons had

three parts: presentation, comprehension check with multiple-choice answers, and an answer check. The material emphasizes main thought or idea, specific word meanings, and general comprehension. Two lessons were presented per week for 10 weeks. Forms 3A and 3B of the STEP Listening Test were used as pre and posttest criterion measures. Virtually all reading was eliminated from the answer sheets to avoid criticism that this was a reading test rather than a listening test.

Results showed that both groups which received one of the two sequences of listening comprehension instruction showed a significant increase in comprehension while the control groups, which received no instruction, actually showed a loss. There was no appreciable difference in results in relation to the types of instructional material used.

Bischoff concludes that it appears that listening comprehension can be improved through training. He feels that teachers should become aware that listening comprehension is a skill that can be taught and that they should be trained to teach it. He feels that there is a need for a sequential instructional program in this area since the short term procedure used in this study significantly increased the listening efficiency of the students.

Kurfeerst, I. A teacher's guide for a sequential pattern of auding. Doctoral dissertation, University of Pittsburgh, 1972.

Kurfeerst (1972) developed a series of lessons based on extensive reviews of literature and by circulating a questionnaire among teachers of visually handicapped students and high school and college students who were blind. The problem to be investigated was stated in the following questions:

1. Is there a rationale for teaching auding skills to blind children?

2. What constitutes an appropriate pattern for teaching auding skills to blind children?

In order to answer the first question, an extensive review of literature on auding was conducted. Results of the review revealed that auding was an extremely critical skill, particularly for blind children, and there is indeed a rationale for teaching these skills. The rationale includes the principles that:

a. Auding is an integral part of life
b. A direct relationship exists between auding and academic areas
c. Auding skills can be taught
d. Auding is a more efficient means of learning than braille reading
e. A theoretical foundation for teaching auding skills was established - this was based on Carroll's Descriptive Linguistics (1961) and Wepman's Auditory Discrimination (1960).

To answer the second question, literature related to the education of the blind, auding and blindness and components of auding was conducted. Results of this review indicated that the pattern for teaching auding skills should meet the following criteria. It should be developed:

a. for administration in the school setting
b. for introduction at an early age
c. in a developmental order

Kurfeerst further states that the two reviews provide substantial evidence for the value of developing an auding pattern containing the noted characteristics described in the literature and employing the following criteria:

1. Designed for use by the blind
2. Designed for use in early school setting

3. Designed for use by itinerant teachers
4. Consistent with the sign system of a language as developed by descriptive linguistics and the sequential development of auditory discrimination

In addition to these four criteria, two other general critera are also employed in the study: (1) pupil participation through active response to stimuli increases learning, and (2) immediate reinforcement and detailed feedback provide for more effective learning.

The auding pattern which was developed consists of three units. The first is structured upon Wepman's initial step in the development of auding discrimination: environmental sounds. The last two units have origins in Carroll's descriptive analysis of language: phonemes and forms. The lessons developed as a result of the study are based on these three units. The content of the lessons was obtained in the following manner. The environmental sounds were chosen on the basis of a questionnaire completed by six teachers of visually handicapped children and six blind high school and college students. The phonemic sounds and forms are English language phonemes and are presented according to the developmental pattern of acquisition. The structure of each unit provides for an oral introductory lesson, two recorded unsupervised lessons, and an oral quiz. Examples of lessons in all three units are provided. Also, a complete and extensive list of environmental sounds and phonemes for use in planning future lessons are included.

Studies Related to the Relative Efficiency of Listening and Reading

Perhaps the most significant research related to learning through listening by the visually handicapped has to do with the relative efficiency of listening and reading. Considerable emphasis has been placed on this

aspect of learning and a more organized and systematic body of research is available in this area than in other areas of listening research for the visually handicapped. The research will be reported in chronological order except that reviews of studies on compressed speech will not be included here unless they are referred to in statements of comparison. Compressed speech studies will be reviewed in a later section of this paper.

Lowenfeld, B. Braille and talking book reading: A comparative study. New York: American Foundation for the Blind, 1945.

Ages

Third grade	11.4 yrs.
Fourth grade	12.5 yrs.
Sixth grade	14.9 yrs.
Seventh grade	15.7 yrs.

One of the initial studies comparing the relative efficiency of listening and reading was conducted by Lowenfeld as early as 1945. It was the purpose of this study to compare the effectiveness of braille and talking book reading in regard to speed and comprehension and also to consider the preferences of blind children for one or the other mode of reading.

Two series of experiments were conducted. In Series I of the experiments, 122 third grade and 138 fourth grade pupils in twelve residential schools for the blind were given 24 tests selected from the McCall-Crabbs Standard Test Lessons in Reading. Six test lessons were presented in each of the following modes:

1. Braille Reading
2. Talking Book Reading
3. Talking Book Reading with sound effects
4. Talking Book Reading with dramatizations

The comprehension scores of the pupils and their rates of braille reading form the basis for the statistical analysis of the study. Comprehension scores of the four modes of reading were compared for the two grades and those of the braille and Talking Book straight reading also for different levels of intelligence. Rates in braille reading (grade 1 1/2) were determined for third and fourth grade and were compared with the Talking Book straight reading rate and with norms for visual silent reading. Attention was also given to variation in braille reading rate on each grade level for the various schools participating in the study. The pupils were asked to list the four stories they liked best in the order of their preference and their responses were tabulated according to modes of reading.

In Series II of the experiments, 109 sixth grade and 112 seventh grade pupils were given 12 tests from the McCall-Crabbs Test Lessons in Reading, 6 of which were presented in braille and 6 in Talking Book straight reading. The tests in each mode of presentation included three "storytelling" passages and three "textbook" passages. Braille and Talking Book reading comprehension scores on each type of material were compared for the two grades and for different levels of intelligence. Rates of braille reading (braille, 1 1/2) were analyzed as in Series I.

The results showed that the median rates of braille reading on graded materials were as follows: Grade 3 - 51 wpm; grade 4 - 58 wpm; grade 6 - 59 wpm; grade 7 - 62 wpm. A comparison of rates of braille reading from school to school revealed that there are great differences in the median rates for any one grade level - at each level the highest median found was about twice the lowest. The results also indicated that pupils in one school tend to belong either to the group of slow rate readers or to that of fast rate readers.

The Talking Book Reading rate in this experiment was 171 wpm for grades 3 and 4 and 158 wpm for grades 6 and 7. On this basis pupils of the four grades in the study read on the average 30, 34, 37, and 39 words respectively in braille for each 100 words read on the Talking Book or, roughly, about one-third as fast in braille as by Talking Book.

When the braille reading rates were compared with norms for silent visual reading, it was found that seeing pupils on the third grade level read about twice as fast as blind pupils on the fourth grade level, about three times as fast on the fifth grade level, about three and a half times as fast on the sixth grade level, and on the seventh grade level, about four times as fast.

On the third and fourth grade level (Series I) reading comprehension by Talking Book straight reading was significantly superior to that of braille reading by a margin of about 4 months in grade score achievement. The difference in comprehension between Talking Book reading and Talking Book reading with sound effects was very small and statistically not significant. The results in regard to Talking Book reading with dramatizations indicated a need for further experimentation because the passages used in this study were too short for effective dramatization.

The comparison of braille and Talking Book straight reading scores for different IQ groups on the third and fourth grade level indicated that the differences in favor of Talking Book reading were considerably greater for pupils in the group with IQ's below 90 than for those in the higher IQ groups. This shows that, on this grade level, pupils of lower intelligence comprehended much better by Talking Book than by braille reading while the more intelligent pupils comprehended well by either mode of

reading although there is still a difference in favor of Talking Book reading. A comparison of the standard deviations revealed that Talking Book reading resulted in a more homogeneous group of scores than braille reading and that the addition of sound effects or dramatizations to Talking Book reading accentuated the differences from pupil to pupil.

In Series II (sixth and seventh grades) the differences in comprehension for "story" tests were small and insignificant, demonstrating that pupils comprehend this type of material as well by braille reading as by Talking Book reading. For "textbook" tests comprehension scores in braille reading were significantly superior to those in Talking Book reading by a margin of 5.3 and 4.5 educational months for sixth and seventh grades respectively. These results may be explained by "past practice and habituation" since pupils were used to comprehending information from textbook material by braille reading rather than by listening. The difference in favor of braille was considerably larger for pupils in the group with IQ's below 90 than for those in higher IQ groups. In addition to the above mentioned factor of "past practice and habituation" the opportunity to adjust reading speed to comprehension, which is a concomitant of braille but not of Talking Book reading showed the same amount of scatter.

The achievement in comprehension as expressed by the median scores for braille and Talking Book reading showed differences from school to school within any one of the four grade levels, as would be expected. While these differences were small on the 3rd and 4th grade levels they were very considerable for 6th and 7th grade.

The omission of the time limit in the experiments made it impossible to compare the scores with the norms for seeing pupils. The

grade scores in braille as well as in Talking Book reading were above the actual grade of the pupils. The age scores practically corresponded with the mean age on the third grade level but fell increasingly behind from fourth to seventh grade. At the seventh grade level the age retardation in both braille and Talking Book reading comprehension amounted to about 2 years.

Of the stories selected by the children as their preferred ones, about 10 per cent were read in braille; about 15 per cent on the Talking Book (straight reading); and about 35 per cent on the Talking Book with dramatizations; and about 40 per cent on the Talking Book with sound effects. This distribution of the children's preferences seemed to indicate that sound effects and dramatizations added considerably to the attractiveness of the material presented.

This study can be summarized as follows:

For children in grades three and four, comprehension for both textbook and story-telling passages was significantly greater when the method of presentation was auditory. Children in grades six and seven comprehended story-telling passages equally well for auditory and tactual modes of presentation. However, comprehension of textbook passages was significantly better for braille reading. In all cases, the differences among mean comprehension scores, even when statistically significant, were small. When viewed in terms of the time disparity between listening and braille reading, the differences in favor of braille reading appear to have no practical value. In fact, from the standpoint of efficiency, listening appears to be superior to braille reading.

Nolan, C.Y. Reading and listening in learning by the blind. *Exceptional Children*, 1963, 29, 313-316.

Grades - 6-10

In preparation for an extensive series of studies on the relative efficiency of reading and listening to be conducted at the American Printing House for the Blind, Nolan conducted a preliminary study which is reported below. The study was designed as a pilot study to identify technical and methodological problems which required consideration in the planning of the research mentioned above.

The design of the experiment required a comparison of learning attained through listening and through reading when amount of practice were varied through two, four, and five sessions held on consecutive days. Seventy subjects were divided into seven groups in such a manner that each group contained two subjects at each grade level except in two groups where a grade seven subject was substituted for a grade 10 subject. Three groups were then designated as braille reading, three groups as listening groups, and the remaining group as control.

The material to be learned consisted of a 2094 word passage which described the circulatory system, taken from a seventh grade science book (Fraiser, 1957). For those who read the material, braille pamphlets were prepared in standard textbook format. For listening, the materials were recorded on tape by a professional reader in the Talking Book studios of the American Printing House for the Blind.

The learning experience consisted of reading or group listening to the material once each day. Reading and listening occurred, of course, in different rooms. The control group was not exposed to the material but was tested only on the last day of the experiment. Other groups had two days, four days, and five days of practice with the test given on the last day of practice. Learning was tested by a 36 item four-alternative

multiple choice test which previously (Foulke, 1962) had been constructed for this purpose.

The results of a test of the difference between the control group mean (16.0) and the mean of the combined experimental groups (22.77) were significant beyond the .01 level of confidence, indicating that some learning occurred. Results of an analysis of variance to analyze the differences between the means of the experimental groups reveals no significant differences between listening and reading, amounts of practice, or their interaction.

At first glance, the results of the experiment are quite unprepossessing. While the experiment did fulfill its pilot purpose in identifying troublesome spots in methodology, the results throw no light upon the relative merits for the blind of learning through listening or reading. It is true that listening time was about one-third that for reading, and equal comprehension was achieved, but this information was already at hand (Lowenfeld, 1945, Foulke, 1962).

It is only when considered in relation to findings of research on listening and reading with seeing children that our results appear of interest. Seeing children in the upper grades comprehended better through reading than listening (Caughran, 1953) and this effect was more pronounced for difficult materials (Carver, 1941). In this experiment the subjects were upper grade students and difficult scientific material was used. Why was there no difference in favor of learning through reading? The answer may exist in the relative rates of communication possible through the various modes of communication. In recording Talking Books at the American Printing House for the Blind, an attempt is made to record at 175 wpm. When we examine sighted reading speeds (Lowenfeld, 1945, p.20) it is found

that average reading rates for grades four and below are less than this (175 wpm) and that average reading rates for grades six and above exceed this speed by a considerable margin. However, when we examine average reading speeds for braille, it is found that even at grade 12 these are only 90 wpm (Ethington, 1956).

From the above it may be hypothesized that, other things being equal, the relative rates of communication by reading and listening may be related to whichever proves superior. When reading rates are slower than listening rates, listening comprehension may be superior. When reading rates are faster than listening rates, reading comprehension may be superior. For the blind, reading rates rarely exceed listening rates. However, it must not be assumed that relative communication rate is the only factor in operation. In fact, Lowenfeld's findings indicate that difficulty of material may be involved. Review of the literature reveals that many factors are apt to be involved in the relative comprehension for listening and reading by both the blind and the seeing (Nolan, 1962).

It is believed that the results reported above emphasize the need for intensive research on the relative efficiency, for the blind, of learning by reading and learning by listening. It may be that by overemphasis on reading as a means of learning, we are increasing the number of obstacles in the educational paths of the blind.

✓ Nolan, C.Y., Morris, J.E., Kederis, C.J., Fieg, K.E., & Smith, M.G. Reading and listening in learning by the blind: Progress report. Louisville, Kentucky: American Printing House for the blind, December, 1966.

This progress report described the first eight studies in a series of fourteen studies on reading and listening in learning for the blind which were conducted at the American Printing House for the Blind. The period covered by the entire series of studies was from September 1, 1963 until

April 30, 1968. The major objectives of the series of studies were:

(a) To determine the relative efficiency of listening and braille and large type reading as a means of learning subject matter of different types.

(b) To determine the relative efficiency of different rates of auditory communication for learning subject matter of selected types.

(c) To identify listening techniques useful for the blind.

The eight studies included in this progress report pertain to the first and third objectives. Studies related to the second objective are described in the Terminal Progress Report and will be reviewed later.

I. Variables Related to Listening by the Blind

Ages 12-24 yrs.

Grades 4-12

✓ The first of the eight studies is concerned with variables related to listening by the blind. The variables under study were those of academic achievement and mental ability as they relate to listening ability. The purposes of the study were exploratory. They included a try-out of the STEP Listening Test with groups of blind students and a determination of the relationships of the obtained measures with measures of academic achievement and mental ability.

The subjects were one hundred thirty white and one hundred negro students in grades 4-12 who were enrolled in separate schools for the white and negro blind. Several types of data were gathered describing the subjects. These were: (1) listening comprehension, using the STEP Listening Test-Form B; (2) academic achievement, using the Stanford Achievement Test-Form K; (3) mental ability, determined by IQ scores obtained from school

records; (4) personal adjustment ratings, gained from ratings by houseparents and teachers; (5) visual acuity measures from students school records; and (6) listening practices, obtained from interviews with users of recorded material.

Analysis of this data revealed that the white groups in all cases scored above the norm midpoint on the STEP Listening Test, but negro groups did not for reasons which were not apparent. Correlations for mental ability and academic achievement to listening ability appeared to correspond to findings reported previously in the literature indicating a strong positive relationship between IQ, most areas of academic achievement, and listening ability. There were no significant differences in listening ability related to visual acuity. It was of interest to estimate whether a relationship existed between Listening Test score and adjustment ratings. Results of this analysis revealed some trend for higher Listening Test means to be associated with higher adjustment ratings. This was particularly true for negro students. Results of the interviews with users of recorded material showed that students in this study engaged in almost no formal study using recorded textbooks or other materials.

In general, results of this study indicate that listening is related to educational and personal variables of the blind in much the same way as for the sighted. Some differences were found for negro students, but these could not be accounted for on the basis of the date available. It was surprising to find that almost no use was made of recorded materials for study and very little for recreational purposes.

II. Interviews with users of Recorded Texts

Grades 9-12

The second study in this progress report deals with interviews with blind high school students for the purpose of identifying listening techniques useful to the blind. Subjects were both braille and large-type readers. Prior to the interview, the purpose of the study was explained to the subjects and the STEP Listening Test Form B was administered. Results of the Listening Test revealed the subjects to be a superior group of listeners.

The interviews covered the following aspects of listening techniques:

A. Materials Used
    1. Subjects for which recorded texts were used
    2. Student preferences for recorded and printed texts

B. Study Environment and Equipment
    1. Equipment used to study
    2. Student comments on equipment
    3. Place of study
    4. The problem of environmental noise

C. Textbook Formats
    1. Present formats for recorded texts
    2. Student comments on the table of contents
    3. The problem of finding a particular place in a book
    4. Textbook format, vocabulary development, and spelling
    5. The problem of nonverbal graphic displays

D. Study Techniques
    1. Learning how to use recorded books
    2. Scheduling of study and time requirements
    3. The problem of attention

4. Note taking
5. Use of earphones

E. The Comparative Usefulness of Recorded and Printed Texts

The results of these interviews indicated that many incompatibilities exist among the playback equipment, recording formats, writing equipment, and techniques students use. Comments from the students provided information about specifications for adequate playback equipment and recording formats. It appeared that techniques for using recorded texts were extremely varied. For many students the listening experience was passive to the extent that little learning seemed possible, while for others it is an active experience involving some interaction with the material being learned. Note-taking is an example of this activity. However, even though it appeared that recorded note-taking techniques might be the most efficient way of learning while using recorded texts, the interviews revealed a very limited use of this technique by the students interviewed. Other findings were that some types of subject matter, such as mathematics and science, do not appear to be amenable to presentation in recorded form. It was concluded that further study is needed related to playback equipment and techniques students use when studying from recorded material and, also, related to the effects of active and passive listening on learning.

III. Relative Efficiency of Reading and Listening

Grade Levels

Elementary	4-6
High School	9-11 (for science and social studies grades 11 and 12 were combined)

✓ The remaining studies in this progress report are six parallel studies related to the relative efficiency of reading and listening. The

report includes reports on primary findings on the relative efficiency of learning through reading and listening and the results of the differences in learning between modes of presentation, amount of practice, type of student, and grade level of student. Secondary findings of reading rates were also reported because of the wide interest in them. These are the first studies in which reading rates for legally blind print readers have been reported.

The six studies were conducted in the subject areas of literature, science, and social studies. Separate studies were conducted in elementary school and high school for each subject area. The research design was such that data from each of the six groups could be analyzed by separate analyses of variance of the treatments x treatments x treatments x levels type (2 x 2 x 2 x 3). Treatments under study in each of the six analyses were made of learning (reading or listening(type of reader (braille or print), and amount of practice (one-day or three0day). Grades constituted the three levels in each study.

One hundred and ninety-two subjects participated in each of the six studies making a total of 1152 subjects. All were legally blind although some read print. They were from eleven public school systems and eighteen residential schools. One-fourth were elementary braille readers, one-fourth elementary print readers, one-fourth high school braille readers, and one-fourth high school print readers.

To compare the effectiveness and efficiency of learning through reading and listening for both levels of the three types of subject matter under study, four treatment groups were stipulated. Subjects were randomly assigned to these groups which were a one-day reading group, a three-day reading group, a one-day listening group, and a three-day listening group.

Three-day groups were used to ascertain the effect on learning of repeated exposure to the material. Students in these groups either read or listened to their material for three consecutive days. Immediately after each subject completed either reading or listening to his selection for the predetermined number of days, the appropriate test, given under conditions of unlimited time, was administered to measure the amount of learning.

Results showed that in all six analyses the amount learned was positively and significantly related to practice. This meant that, in every case, more was learned by the three-day groups than by one-day groups.

Some other findings, relevant to the primary purpose of the study, were that high school groups learned significantly more social studies and literature through reading then through listening. The mode of learning made no difference in the amount of science they learned. With the high school groups studying literature, a relationship was found between practice and grade level. Here, students in the higher grades learned more additional practice than did students in the lower high school grades.

More variance was found among the elementary groups than among the high school groups. In addition to the positive relationship between learning and practice, a grade level difference was found for all three subject matters. In each case, more was learned by students in the more advanced grades than by those in the lower grades. A significant relationship was also found between practice and grade level for elementary students studying the science material. As with the high school literary groups, students in the higher elementary grades learned more science with additional practice than did those in the lower grades.

The most important of these findings was that, among elementary students, there were no significant differences in the amount learned through reading and through listening for any of the subject matters under study. Likewise, there was no significant difference in the amount of science learned through reading or listening by high school students, although, the high school group learned more social studies and literature through reading than through listening. The latter is interesting in that it is contrary to what might be expected, the scientific material being considerably more technical content than either social studies or literature.

Reading rates were established from the initial rates at which subjects read their respective selections for which unlimited time was given. In an attempt to determine realistic study rates subjects were instructed to read carefully as they would be tested in what they read. Speed was not emphasized. It was found that elementary braille students read at rates averaging from 50-60 wpm while print students read about 18 wpm faster with an average rate of 71 wpm. High school braille students read at average rates of 65-74 wpm while high school print readers read about 12 wpm faster, averaging 83 wpm.

In order to compare the respective amounts learned through reading and listening, efficiency measures were computed by dividing the average number of correct responses on the tests by the average time spent reading or listening. This yielded a learning per unit of time measure for reading and listening for each subject matter under study at both the high school and elementary levels for both braille and print groups. These values were then compared to give the listening-to-reading efficiency stated as percent. Data from the one-day groups were used for these computations.

Without exception, listening proved to be the more efficient way to learn. The sheer size of the efficiency percentages favoring listening leave little room for doubt. For elementary braille students: 284% more science was learned, per unit of time, through listening than through reading; 360% more social studies; and 322% more literature. Elementary print readers learned 190% more science through listening than through reading; 250% more social studies and 215% more literature. Braille students at the high school level learned 248% more science by listening than by reading; 228% more social studies; and 183% more literature. The advantage of learning through listening for high school print students was 192% for science; 155% for social studies; and 207% for literature. These efficiency measures were computed from material recorded at normal rates. It is hypothesized that they would be increased by use of compressed material if the material was not compressed beyond the point where comprehension would be diminished.

The studies described in this report are reported by Morris (1966) in the report of the American Association of Instructors of the Blind, 48th Biennial Conference.

✓ Nolan, C.Y. Reading and listening in learning by the blind: Terminal report. Louisville, Kentucky: American Printing House for the Blind, 1968.

Grade Levels

Elementary	4-6
High School	8-12

The originally stated aims for this project were given in the progress report (Nolan, 1966) previously reviewed. To reiterate, they were:

1. To determine relative efficiency of listening and braille or large type reading as a means of learning

subject matter of different types.

2. To determine relative efficiency of different rates of auditory communication for learning subject matter of different types.
3. To identify listening techniques useful for learning by the blind.

The first objective was met and was described in the progress report (Nolan, 1966) cited above. The third objective was also met and was described in that report. That objective was expanded in later research which will be reviewed later in this paper. The second objective was met and is described in this terminal progress report on the project.

The six studies described in this report were designed to study the effects of active participation on learning through listening and to compare learning at normal rates with learning at compressed rates under conditions of active and passive listening. The impetus for studying the first variable (effects of active listening) came from results of previous studies on listening by the author (Nolan, 1966) which indicated attentive postures during listening were critical to good listening. The inclusion of the comparison of normal and compressed speech in relation to active and passive listening was due to findings by Foulke and Stritch (1967, p. 27) which suggested that comprehension of compressed speech deteriorates at increased rates of speech because the rate of information input exceeds the information handling capacity of the auditory channel. It was hypothesized that, if this were true, interruption of the message for recitation could result in greater facilitation of comprehension for compressed materials than for those presented at normal rates of speech.

Two similar studies were designed to compare learning achieved under active passive conditions of listening for material presented at normal and moderately compressed rates. One study involved students from grades 4-7 and one involved students from grades 8-12.

At the high school level, a 3 x 3 x 2 factorial design involving random groups was used. The treatments studies were mode of listening, type of material, and rate of listening. The three listening modes consisted of (1) continuous listening, (2) listening interrupted at four intervals for 45-second periods during which time subjects were to mentally review what they had just heard, and (3) listening interrupted at four intervals for four-minute periods during which time subjects were to make written notes on what they had just heard. Types of materials were from the subject areas of literature, science, and social studies. Rates of listening were 175 wpm (normal speech) and 225 wpm (compressed speech).

At the elementary level,a 3 x 3 x 2 x 2 factorial design involving random groups was used. This design was identical with that for the high school except that a grade levels factor was added. Two grade levels, 4-5 and 6-7 were studied since previous research had indicated the presence of grade differences in listening comprehension for elementary students.

A total of 360 students participated in the study. All subjects were braille readers and were enrolled in regular classes in residential schools for the blind.

The materials were taped recordings of the same six selections used in the earlier phase of this project and reported in the progress report (Nolan, 1966) already reviewed. For the studies discussed in this terminal progress report, the selections were reproduced at two word rates;

one being the normal uncompressed rate of approximately 225 wpm. The Tempo Regulator as modified and used by the American Printing House for the Blind, was the device used for compression.

All students assigned to each treatment combination at each school were tested at the same time. For the elementary grades, students falling within two grade levels were scheduled together. At each experimental session, the purpose of the experiments were explained and instructions relevant to the mode of listening to which the group was assigned were given. The continuous listening groups were then exposed to the experimental materials and the other two groups were given a practice period and then given the experimental materials. Subjects were tested for comprehension immediately following exposure to the appropriate materials. Most were given as much time as they needed to finish. If some subjects did not finish, the data was not retained unless they had finished as much as 85% of the questions.

A special feature of these studies was the technique used to assure high levels of motivation. Students were told that they were going to participate in a "listening contest" and that each member of the group achieving the highest average score would receive a prize as a reward. Subjects were not told what the prize would be. Elementary groups competed with each other and high school groups competed with each other.

Results of an analysis of variance for elementary levels indicated that significant differences in comprehension existed among the variables: Type of Material, Rate of Listening, Grade Levels, and for the Rate x Mode Interaction. The order of mean comprehension for Types of Material reflected their reading ease and was from highest to lowest, literature, social

studies, and science. Comprehension for science material was less than 20% as great as that for social studies and literature. Comprehension for materials presented at normal listening rates (175 wpm) proved superior to that for materials presented at compressed (225 wpm) under almost every condition of the experiment. Students in the upper elementary group (grades 6-7) uniformly surpassed those in the lower group (grades 4-5) in comprehension. The significant Rate x Mode interaction results from the fact that while for normal rates of presentation comprehension under all modes was equal, for compressed rates comprehension was greatest for the participation modes with that for note-taking the greatest.

At the high school level, significant differences were found within the variables Type of Material, Rate of Listening, Mode of Listening and for two interactions Type x Rate and Type x Mode. The subjects comprehended from highest to lowest in order were, social studies, literature, and science. Regular rates of presentation were superior almost universally to compressed rates. Mode of presentation significantly affected comprehension with comprehension being highest for the note-taking mode, the thinking mode next, and the continuous mode least. The effects for Rate of Listening were dependent to some extent upon the Type of Material since rate differences produced far less variation in comprehension scores for science than they did for literature or social studies. The effect of Mode of Listening also was dependent upon Type of Material since as the material increased in difficulty through literature, social studies, and science the relative effectiveness of the note-taking mode also increased.

Because of the significant interactions Type of Material x Rate and Type of Material x Mode which were found for the high school groups, additional analyses for each type of material were necessary. These anal-

yses gave the following results:

> For literature both the rate and mode effects were significant. Inspection of means indicate the superiority of normal rates of listening and of the interrupted modes over the continuous.
>
> For science only the mode of listening was significant with the interrupted mode being superior.
>
> For social studies, only the rate was significant with normal rates again superior to compressed.

Results of the studies lend considerable but not uniform support to the idea that active participation in the listening process results in greater learning. At the elementary level this effect was apparent only for the compressed materials, while at the high school level it appeared only in the results for literature and science. Consequently, the degree to which participation contributes to learning through listening seems to depend on factors such as grade level, word rate at which the message is transmitted, and type of material involved. Conflicting effects of active participation at the elementary level present somewhat of a puzzle, i.e., for uncompressed material active participation appears to be accompanied by a slight but consistent decay of comprehension. This is particularly true for note taking. Resolution of this paradox may be found through consideration of development factors in listening comprehension and the information processing capabilities of elementary students.

At the high school level the effects of participation are relatively uniform for both rates of presentation. Students at this level of experience have probably mastered note taking techniques and reached

a level of development in comprehension adequate to handle the relatively low levels of compression used in this experiment without too much difficulty.

An unexpected finding of the study was the consistent superiority of comprehension of uncompressed materials over compressed materials. Past research (Foulke and Stricht, 1967) indicated no difference in comprehension between the two until rates were around 275 wpm. In previous research no effort was made to influence motivation except requests for cooperation which is implicit in most instructions. It is suggested that this practice results in relatively low levels of motivation, leading to depressed levels of performance. These results tend to obscure real differences existing between experimental conditions. Raising performance levels to optimum through the provision of relevant motivators would uncover such differences.

Findings of this study are believed to demonstrate a real difference in comprehension between uncompressed and compressed auditory materials when students perform under motivated conditions. Consequently, many of the earlier conclusions about the greater relative efficiency of use of compressed speech should be called into question and modified.

This series of studies is described by Nolan and Morris (1969) in an article entitled "Learning by Blind Students Through Active and Passive Listening," Exceptional Children, Nov. 1969.

Studies Related to Aural Study Systems for the Visually Handicapped

Subsequent to the completion of the series of studies, just reviewed, related to reading and listening in learning by the blind; another series of studies entitled "Aural Study Systems for the Visually Handicapped" was undertaken at the American Printing House for the Blind.

These studies were intended to follow through with research findings in the former studies. The four goals of the Aural Study Systems project were:

1. To study and identify behavioral and procedural factors related to efficient study through listening
2. To make a task analysis of the job of learning through listening
3. To use the task analysis to design and build a system for study using recorded texts that would coordinate design of playback equipment, recorded book formats, and response systems around the goals for efficient study
4. To evaluate this system through user tests

Studies completed in this project were reported in ten interim progress reports. These reports were as follows:

1. Morris, J.E., and Nolan C.Y.
    a. Interim Progress Report No. 1: A Task Analysis
    b. Interim Progress Report No. 2: Recorded Textbook Formats and Aural Study Methods: A Summary of User Opinions
    c. Interim Progress Report No. 3: Effects of Motivation and Word Rate on Aural Comprehension
    d. Interim Progress Report No. 4: Some Parameters of Learning by Listening
2. Steele, N.W.
   Interim Progress Report No. 5: Learning by Blind Children of Low Ability: The Relative Efficiency of Reading and Listening

3. Brothers, R.J.
   Interim Progress Report No. 6: Effect of Message Length and Frame of Reference upon Learning
4. Morris, J.E.
   Interim Progress Report No. 7: Effects on Aural Learning of a Prior Frame of Reference
5. Brothers, R. J.
   Interim Progress Report No. 8: Effects of Message Length
6. Morris, J.E., Nolan C.Y., & Phelps, B.G.
   Interim Progress Report No. 9: Description of the Aural Study System
7. Morris, J.E., Nolan C.Y., & Brothers, R.J.
   Interim Progress Report No. 10: Field Trial of the Aural Study System
8. Nolan, C.Y., Brothers, R.J., & Morris, J.E.
   Interim Progress Report No. 11: Guide to Effective Study Through Listening
9. Nolan, C.Y., and Morris, J.E.
   Final Report: Aural Study Systems for the Visually Handicapped

The findings of all the studies included in the Aural Study Systems project are summarized by Nolan (1973) in the final report of the project. Since this review of the studies is quite comprehensive, it is included here along with a discussion of the major research findings. The studies completed in this project are divided into two categories: (1) factors related to listening comprehension and (2) development of an

aural study system. The research and development under these two categories are described in the order given and findings from both categories are then integrated.

Nolan, C.Y., and Morris, J.E. Aural Study Systems for the Visually Handicapped: Final Report. Louisville, Kentucky: American Printing House for the Blind, 1973.

Factors in Learning through Listening

These studies were all designed to explore research hypotheses about the listening process that stemmed from research previously conducted at the American Printing House or reported in the general literature. The studies include research on effects of manipulations of motivational variables on relative comprehension for material presented at compressed and normal word rates, exploration of the effects in variations in study time and scheduling on listening comprehension, study of the relative effectiveness of listening and reading for children of low ability, exploration of the effects of varying lengths of message on listening comprehension, and study of the effects of attainment of a prior frame of reference on listening comprehension. All studies have been published in full previously as interim progress reports. Consequently they are briefly summarized here:

1. Interim Progress Report No. 3: Effects of Motivation and Word Rate on Aural Comprehension (Morris & Nolan, 1970a)

Grades 4-12

In 1967, research conducted at the American Printing House (Nolan & Morris, 1969) indicated that, under conditions of high motivation, comprehension by blind students for auditory materials presented at normal rates was significantly superior to that presented under even low levels

of speech compression. This was contrary to most previous research findings.

The purpose of this study was confirmation of these results. Two groups of blind students, 108 from grades 4-7 and 120 from grades 8-12, listened to literary stories appropriate for their grades. Of the total group, one-third listened to a recording at 175 wpm, one-third at 225 wpm, and one-third at 275 wpm. Half the students listened under motivated conditions where each had a chance to win two prizes for superior performance. Half the students listened under conditions where no prizes for superior performance were offered. The major result of the study was that levels of motivation, at least as determined by the procedures of this study, had no effect on the relative comprehension for auditory materials presented at regular and compressed rates.

2. Interim Progress Report No. 4: Some Parameters of Learning by Listening--Part One--The effects on Learning of Repeated Continuous Listening (Morris & Nolan, 1970c)

Grades 4-6 and 9-12

From consumer interviews conducted earlier as part of this research program (Morris & Nolan, 1969), it was learned that users of recorded texts who took notes seldom listened to their texts more than once. They felt that review of these notes was sufficient for further study. This aroused curiosity about the usefulness of repeated listening and the curve for learning resulting when students listen to material for two or three consecutive presentations. Therefore, study of this problem was initiated.

Two duplicate experiments required learning literary and science materials through listening. Participating were blind students from grades

9-12 and 4-6. Equal groups of braille and large type readers were included. The primary factor studied was the amount students learned when they listened once and when they listened to two or three consecutive presentations. Results of the analysis of the data were revealing.

For high school students, repeated listening resulted in significantly increasing amounts of learning. Increases in learning appeared greater for literary materials than for science. Braille readers learned significantly more through repeated listening than did large type readers when science materials were studied. However, for both types of material, the rates of increase in learning with repeated listening were greater for braille readers.

Such was not the case for elementary students who listened to literary and science material. Effects of repeated listening varied unsystematically from grade to grade and between the two types of readers. However, no significant differences were found among the varying amounts of practice. Consequently, it was concluded that for elementary level readers, listening two or three times consecutively failed to improve learning over that attained by listening once.

Consequently, while it appears that high school students derive considerable benefit from listening consecutively to material two or three times running, such is not the case for elementary level students.

3. Interim Progress Report No. 4: Some Parameters of Learning by Listening--Part Three--The Relative Efficiency of Learning through Reading and Listening when Study Time is Held Constant (Morris & Nolan, 1970c)

Earlier research on reading and listening in learning by the blind

(Nolan, 1966) is summarized in part two of Interim Progress Report No. 4. This research showed that for literature and science materials, learning by blind students through listening was more efficient than that achieved through braille or large type reading. Listening efficiency was from 183-320% greater when amounts of learning per unit of time spent was the criterion. Combining the results of this research with those reported in part one above enabled comparison of efficiency of learning through listening and reading when study time was held approximately constant. Eight comparisons were available for groups of braille and large type readers at both elementary and secondary levels who read or listened.

For both elementary and high school students, required reading time was double listening time with two exceptions. Reading times for braille students were triple listening times for both literature and science.

In five of the eight groups learning resulting from multiple consecutive listenings exceeded that resulting from one reading of the same material by 10% or more; however, in no group did the difference in the means for learning under the two conditions approach statistical significance. Therefore, it does not appear to matter, in terms of total study time, whether a student reads his material once or listens to it two or more times consecutively. In view of the findings in part one that consecutive listening may degrade learning performance of elementary students, a comparison of performance with distributed practice is of interest. Appropriate data are only available for the braille students. Analysis of these results indicated that elementary students, listening under distributed practice an equivalent time to that required for reading, do learn significantly more literature but no more science.

4. Interim Progress Report No. 4: Some Parameters of Learning by Listening--Part Four--Learning through Listening when Practice is Massed and Distributed. (Morris & Nolan, 1970c)

In earlier listening research (Nolan, 1966), learning for literature and science through listening and reading was compared when visually handicapped elementary and high school students listened to materials for one day and on three consecutive days. Combining these results with those of Part One above allowed comparison of learning through listening when students listened consecutively three times on one day with that achieved when they listened three times on consecutive days. Findings from the field of learning would lead to the prediction that listening practice distributed over a three day period would result in more learning.

This was the case for elementary level children. Listening once on each of three days yielded about 33% greater learning than continuous listening. These differences were statistically significant. However, such was not the case for high school students. Listening consecutively three times on one day produced a nonsignificant 12% more learning than when listening was distributed over three days.

✓ 5. Interim Progress Report No. 5: Learning by Blind Children of Low Ability: The Relative Efficiency of Reading and Listening (Steele, 1971) Ages 9-20 yrs.

The study was designed to compare the relative comprehension of low IQ students for materials presented in braille and recorded form. The subjects were 80 blind students from five residential schools whose IQ's were 85 or less, who ranged in age from 9-20 years, and who had

received braille instruction for at least 3 years. On the basis of a reading test, these students were divided into four groups of readers who possessed high reading rates--high comprehension, high rates--low comprehension, low rates--high comprehension, and low rates--low comprehension. The four groups were randomly divided so that half read materials in braille and half listened to the same materials. All subjects read or listened to two passages at the second and six grade reading level. Students read or listened to the materials only once and were tested for comprehension by a multiple-choice braille test immediately after. The general outcome of this study was that, for students whose reading comprehension was high, reading was the superior medium. For students whose reading comprehension was low, listening was the superior medium.

6. Interim Progress Report No. 6: Effect of Message Length and Frame of Reference Upon Learning (Brothers, 1971a)

Grades - High School

Learning theorists have long considered the amount of material attempted and a prior frame of reference about what was to be learned significant factors in learning. To explore the relevance of these factors for listening through learning, 160 blind high school students divided into higher and lower groups according to mental ability listened to a recording of historical nature. Equal groups of students listened to the 24 minute recording when it was divided into 2, 3, 4, and 6 minute segments. Students took notes during the times between segments for periods designed so that total task time for all groups was equal. Prior to listening to their assigned segment length, one-half of the group heard a 1 minute summary of

the total message while a control group heard a 1 minute message of non-specific information about the text. Analysis of the results revealed no significant effects due to variation of message length or presence or absence of a prior frame of reference as defined by the study.

7. Interim Progress Report No. 7: Effects on Aural Learning of a Prior Frame of Reference (Morris, 1971)

Grades 6-12

Four studies of identical design were conducted in this area. They varied only in type of material used and educational level. These were intermediate social studies, intermediate science, high school social studies, and high school science. Grades comprising the intermediate groups were 6, 7, and 8. Grades comprising the high school groups were 9, 10, 11, and 12. The purpose of these studies was to follow up on work done by Brothers (1971a). Specifically, these studies concerned how prior frames of reference affected aural learning. Evidence from the field of perception supports the expectation that a prior frame of reference should enhance learning.

In each study three experimental groups were used; one having no frame of reference, one using a general frame of reference, and the third using a very specific frame of reference. Other major effects under study were type of reading medium used (braille or large type) and grade level.

A total of 484 blind subjects was used in these studies. Results supported Brothers'findings in that no significant differences in learning

resulted from prior use of a frame of reference, either general or specific, in any of the four studies. However, there was a trend for learning scores to increase as the specificity of the frame of reference increased for the social studies material at both levels. The only statistically significant finding from these four studies occurred at the high school level within the social studies condition where braille students learned more than large type students (.01 level) and where student learning was positively related to grade assignment (.05 level).

8. Interim Progress Report No. 8: Effects of Message Length (Brothers, 1971b)

Grades - High School

This was an investigation of message length and its effect on' immediate and delayed recall. Forty blind high school students participated in the study. Six braille and four large type readers were assigned to each of four conditions. The conditions consisted of a 24 minute message, the same message divided into four segments of 6 minutes., three segments of 8 minutes, and two segments of 12 minutes in length. Following the presentation of each message segment, students responded to a series of questions based on the part they had just heard. The measure of delayed recall was obtained using the same test after a period of 3 days.

The results supported earlier findings that segmenting the stimulus material in varied message length does not significantly affect comprehension or recall scores when the subjects have equal time to interact with the materials. Scores obtained immediately were significantly higher than those obtained 3 days leter, but there was no evidence that message length conditions had any differential effects on comprehension

for short or long delays. It was noted that braille readers scored significantly higher than large type readers under the delayed recall condition.

Development of an Aural Study System

The initial studies in this development involved a task analysis of study through listening and an intensive interview study of experienced users opinions about recorded textbook formats and aural study methods. Information derived from these projects was combined with that generated earlier (Nolan, 1966) to develop a set of specifications for the Aural Study System. The system was subsequently designed according to these specifications. Following design it was field tested. Finally, information developed throughout the project and earlier was used to write a study guide. Since all these reports have been published previously, they were only summarized here.

1. Interim Progress Report No. 1: A Task Analysis (Morris & Nolan, 1970d)

In order to design an aural study system, a thorough understanding of the tasks involved in study through listening is necessary. To gain this knowledge, an analysis was made of the processes involved in studying from recorded textbooks. The books used were three previously recorded at the American Printing House in the Talking Book program and the equipment used was an APH Talking Book Reproducer. The analysis resulted in identification of 24 distinct tasks involved in study from records. The steps necessary to complete each task were described in detail by identifying each necessary response, sequentially, along with the cue initiating it.

This information was then used to help generate a tentative set of specifications for the design of playback equipment to be used in a study system.

2. Interim Progress Report No. 2: Recorded Textbook Formats and Aural Study Methods: Summary of User Opinions (Morris & Nolan, 1970b)
Grade - College Students

Eighteen visually handicapped students at the University of Texas who were experienced users of auditory textbooks participated in each phase of this study.

Textbook Format: Three high school textbooks from the fields of literature, social studies, and science were analysed to identify their constituent parts. Lists of the 14 parts identified, along with a definition of each were reproduced in braille and large type. The lists were distributed to the blind subjects who were required to submit a written report giving a judgement of whether each book part would be more useful in written or recorded form and discussing their reasons for each judgement. The experimenters reviewed each report and explored any ambiguous points with each subject in an interview.

Eighty-three percent of the students preferred recorded texts with the exception of texts in mathematics, physical science, and certain languages which were more easily understood in written forms. With respect to parts of books, recorded forms were preferred for prefaces and/or forewords, acknowledgements, introductions, footnotes, and suggested activities while tables of contents, graphics, study questions, references, glossaries, and indexes were preferred in written form.

Aural Study Methods: All students were interviewed in depth on 19 questions related to study. Scheduling, understanding graphics, drowsiness, note-taking, place finding, and indexing were identified as critical areas in study through listening and methods for overcoming problems in these areas were suggested.

3. Interim Progress Report No. 9: Description of the Aural Study System (Morris, Nolan, & Phelps, 1973)

Final specifications for the system were developed using all previous work as input. Printing House engineers developed an experimental model to fit the specifications. Development was intermittantly reviewed by the project staff as well as an outside panel of experts who were visually handicapped. When specifications were finally met to the satisfaction of the reviewers, development was terminated. The system as developed consists of a specially designed record format, a specially designed record player, and complementary written materials.

The specially designed record has two tracks recorded in each groove which can be played independently. One track (recorded at 66-2/3 rpm) contains the text of the recording. The recording on each record side can be divided into up to nine parts by narrow bands (.062 inch) which are blank. Information about the range of page numbers or letters of the alphabet recorded on each record can be listed on the record jacket.

The special record player has the following features: (a)forward and backward turntable action, (b)instantaneous turntable stop-start, (c) capability to play the two recorded tracks independently at the appropriate speeds, (d) a continuously variable playing speed control, (e)a tone arm having a retractable pickup cartridge incorporating a mechanism for

positively identifying the record edge and featuring stylus pressure light enough to prevent record damage through mishandling the tone arm, (f) a photoelectric cell in the tone arm that detects the unrecorded bands on the record and causes a tone to sound when the stylus is directly over the narrow empty band, and (g) a foot control for remote operation of the four modes--play, stop, fast reverse, and fast forward.

The complementary written materials consist of booklets, containing such things as a table of contents, lists of chapter titles and headings, spelling lists, study questions, graphics, and indexes.

To find a specific subject in a book, the user must first know the appropriate index term (page number or alphabetical listing) under which the item can be located. By entering appropriate lists, he can then identify the appropriate record and record side. Survey of braille or large type lists on or in the record jacket indicates the appropriate part of the record. The beginning of this part can be located by using the photoelectric cell in the tone arm to count the bands as the tone arm crosses them. The stylus can be placed on the appropriate band by maintaining the tone while the stylus is lowered through release of a lever. Engaging the fast forward control of the player switches to the index track of the record which is searched at 66-2/3 rpm. Once the index term is heard, disengaging the fast forward control instantaneously returns the equipment to regular play upon which the start of the material desired can be heard. Search within sections of material such as pages for specifid facts is aided by increasing the rate of play with the variable speed control.

4. Interim Progress Report No. 10: Field Trial of the Aural Study System (Morris, Nolan, & Brothers, 1973)

Grades 5-12

The equipment and materials of this system include a record player designed to be used for study, an especially designed stereophonic record, a written key relating page number to record part, and a written supplement containing materials previously determined as not appropriate for aural presentation; namely, a table of contents, an outline of headings, spelling lists, study questions, references, bar graphs, a table, graphics, and an index. The written materials used in the field trial were in braille. The topic of the recording and its accompanying braille supplement was a unit of South American history taken from a world history book. Four record players were built for use in the field trail.

In the first phase of the field trail 36 blind students who read braille, ranging in grades from 5 through 12, were trained to use the various components of the system. Students spent one class period on four consecutive school days learning and practicing. On the fifth day they were tested. Of the 36 subjects, 35 performed at an acceptable level. Midway through this phase of the field trail an electrical circuitry problem was corrected in the players and the training procedure was modified as the students were learning more readily than anticipated.

Twenty-four high school level students who had been taught to use the system in the first phase of the field trail also participated in the second phase. Only high school students were used in this phase of the field trail as the content of the material was appropriate for students at this level. These students were given one class period of review and then spent three class periods (one per day) performing study tasks using the system. These tasks included locating and writing out short form answers to study questions, copying quotations verbatim, out-

lining, and summarizing. Although the quality of the written responses varied over a wide range, all students were able to use the Aural Study System to perform these tasks with no particular problems being encountered. The data collected provides for a comparison of the time required to perform these study tasks using hand and foot controls.

Information acquired from the field trail has indicated where minor modifications in the Aural Study System would be desirable. Overall, the results were extremely positive.

5. Interim Progress Report No. 11: Guide to Effective Study through Listening (Nolan, Brothers, & Morris, 1973)

This is a general guide to study through listening. Information in the guide was derived from interviews with visually impaired students who were experienced users of recorded texts, from research on listening, and from general "how to study" manuals. Topics covered in the manual include the role of listening in study, preparations for learning by listening, methods for study, and obtaining materials through local sources. The guide will eventually be distributed in recorded as well as written form.

Major research findings from each of the two categories of studies in the Aural Study Systems project are briefly summarized below:

✓ Factors in Learning through Listening

1. As in previous research, a positive correlation was found between IQ and listening comprehension.

2. As in previous research, listening comprehension was found to increase with grade level.

3. As in previous research, braille readers often attained higher comprehension scores than large type readers. While some of this

difference may be attributed to differences in mental ability between the groups, part probably results from the greater necessity of severely visually handicapped students to rely on listening as an information source.

4. Elementary level children showed no increase in learning scores when the number of successive presentation of auditory materials was varied from one through three. For high school students learning increased progressively and significantly with repeated successive listening. Limits of learning for these students did not seem to be attained after three presentations.

5. There was no significant difference in learning between reading and listening when study time was held approximately constant.

6. For elementary students exposed to three listening presentations, learning was superior for listening distributed over three days to that for listening massed in one day. High school students learned equally under massed and distributed conditions. Differences between length of attention span for the two grade level groups is probably responsible.

7. For low ability visually handicapped children, listening becomes a superior learning medium to braille only when braille reading comprehension is poor.

8. Segmenting a longer (24 minute) message into shorter segments for listening does not contribute to comprehension when total time on task is held constant. Neither is length of message segment related to delayed recall.

9. Presenting the listener with a general or specific summary of the message to be heard prior to listening does not enhance listening

comprehension.

Development of an Aural Study System

1. The task analysis of study using books recorded on discs and played on a Talking Book reproducer identified 24 tasks. These could be divided into setup tasks, operational tasks, and study tasks. Setup tasks include identifying recorded material by its ink-print page numbers; finding proper record and side; setting up player; turning on player; adjusting tone, volume, and speed; and finding place on recording. Operational tasks include turning off player and removing pickup arm from discs, turning off player with pickup arm left in place, turning on player with pickup arm in place, pausing, moving pickup arm in fine gradients, changing discs, replaying a short section, speeding up play, slowing down play, skipping, and scanning rapidly. Study tasks included finding a topic in a recorded table of contents, finding a topic in a recorded index, searching for specific information in the text, taking notes, copying verbatim a recorded selection, learning new words, and interpreting verbal description of nonverbal ink-print graphics.

2. Eighty three percent of 18 college students expressed a preference for text material in recorded form. Excepted were texts in mathematics, physical sciences, and language.

3. Students expressed clear preferences for textbook formats. Recorded forms were preferred for prefaces, forewords, acknowledgements, introductions, footnotes, suggested activities, and the text proper. Parts of the book preferred in printed form were those frequently used and included tables of contents, graphics, study questions, references, glossaries, and indexes.

4. With respect to study patterns and problems, students preferred concentrating on one subject at a time, listening only once, and taking notes. Subjects such as history and literature could be studies in mass fashion, while mathematics, science, and languages required distributed study. Reviewing notes was the primary method of text preparation. All students reported taking notes in summary, outline, or item form. Notes taken were either written or recorded. Passivity of the listening situation contributed to loss of attention and drowsiness. This was counteracted by engaging in activities which were directly or only marginally related to study purpose. Place finding was a severe problem in study.

5. The design of an Aural Study System was defined to include a special record, a special record player, and a special written supplement. Specifications for the recording included labels for sides, division of sides into parts by empty bands, stereophonic recording with a content track and index track, and calibration of index and content information. Specifications for the player included a power control; volume control; tone control; speaker or headphone option; three turntable speeds; variable speed capability; forward-reverse turntable options; turntable instant pause; hand controls for fast forward, fast reverse, pause, and play turntable operations; foot control for the same; and a tone arm with retractable cartridge, a record edge finder, light stylus pressure, photoelectric sensor to detect blank bands in the record, and capability to play stereophonic tracks independently. Features to be included in the written supplement were the title page, table of contents, ink-print text chapter headings and sub-headings, spelling lists, study questions, graphics, unit activities, references, and the index.

6. Of 30 separate operational tasks involved in use of the study system, 26 were accomplished successfully by 85% of the test group students from grades 5-12. No grade differences for successful performance were found.

7. With less than 4 hours training and practice, 30 of 32 students from grades 5-12 could find a specific topic within a 3 hour recording in 5.6 minutes on the average. With less than 1-hour additional practice for high school students, mean location time was reduced to 3.2 minutes.

8. High school students with less than 5 hours training successfully performed study tasks which included answering study questions, copying a statement verbatim, outlining a passage, and summarizing a passage.

Surveys Related to the Aural Study Systems Studies

Two additional surveys were used as background for the Aural Study Systems Studies. They are summarized briefly below:

Carter, B. How to Use Educational Recordings Effectively. A Survey of Blind College Students. New Outlook for the Blind, 1962, 56, 332-334.

Grade Level - College students

Carter surveyed blind college students to determine the uses made of recorded materials by these students. One of the objectives of the study was the preparation of a manual for use by blind students; another was to find out whether or not the blind college student is able to compete with his sighted peers, and if so, how he does it. Personal interviews were conducted with 366 full-time blind college students throughout the country on the basis of an hour-long questionnaire.

The survey revealed that the average number of pages of text-

book materials read per week was 300, thus, the principal method of study employed by college students was by listening. Those students who read (listened) more were more likely to have higher grades and were rated higher on personal characteristics. Carter reports that about 86% of the study of these students was through listening. Of this, 43% involved material read directly to the student by sighted readers and 43% involved material in the form of discs or tapes. Methods suggested for use in study through listening included (a) taking notes while listening; (b) use of a tape recorder to selectively record important parts of material; (c) development of a recording habit through listening a great deal; selectively re-running important passages, budgeting time for listening and development of techniques; and (d) learning to concentrate while listening to recordings. While these suggestions appear quite positive, exactly how to accomplish them is not very clear.

In general,the survey revealed that blind college students, or at least those who use the service of Recording for the Blind, achieve at a high level. The amount of textbook material that they read per week compares favorably with estimates of reading done by sighted students. Learning by listening is the principal method employed by the blind college students, approximately half the reading being doe by means of recordings. Those who use recordings also read more. There was a high correlation between the amount of material read and the grades achieved, regardless of what combination of reading methods was used. While mahy preferred to have a sighted reader with whom they could interact, a large number had developed methods of study which made recorded books more useful to them.

The report of this survey recommends that educators of blind children should consider the advisability of introducing recorded material to blind students at the same time as braille or at least shortly

afterwards. There is substantial evidence that the present practice of deferring the use of recordings for several years, until after the child has learned braille, is a handicap to him.

Josephson, E. A report on blind readers. New Outlook for the Blind, April, 1964, Vol. 58, No. 4, 97-101.

Ages - 20 years and over

This article reports a four state survey. The general findings were as follows:

> Most readers depend primarily on records although there is some variation among states. In Portland, Oregon for example, more than two-thirds of the blind readers depend primarily on records; on the other hand, in rural Johnston County, North Carolina, only one-quarter used records, while nearly half relied on sighted readers. Amount of reading varies according to the technique used: more than half of those who relied primarily on records but less than one-tenth of the persons depending on sighted readers had read four or more books in the previous month.
>
> The use of any particular reading mode is influenced by such factors as age, age at onset of blindness, general health, and educational experiences. Thus, while little more than a third of our respondents in the twenty-one to thirty-one age group relied on records and approximately one-fifth used braille, in the seventy to seventy-nine age group nearly two-thirds depended on records and only 3 percent used braille. This of course is closely related to important differences in reading experiences according to the age at onset of blindness.
>
> Not only do readers vary according to technique (many of course use more than one method), they often abandon one mode for another or give up reading altogether. This is especially but not only true of braille readers. To illustrate, half of our respondents not presently getting records had once used them in the past. More striking, although approximately one-quarter of our respondents claimed that they were able to read braille, little more than a quarter of this smaller group were actually using it. Two-fifths of those able to read braille were not reading books in any form, and over 30 percent were relying on some other technique. Such figures reflect the technological revolution in reading which was brought about by the development of the long-playing record. They also support the hypothesis that there has been a steady drop in the number of actual braille readers as blindness has increasingly become a phenomenon of old age. The trend is most definitely toward the use of recorded materials, including tapes.

Summary

Studies reviewed in this paper were those which dealt exclusively with visually handicapped students. Subsequent papers will review studies in which visually handicapped and sighted subjects are compared in relation to listening, and studies dealing with compressed speech as it relates to visually handicapped students. Studies in this paper fall into the following categories:

1. Partial reviews of research
2. Studies related to the meaning of words to the visually handicapped
3. Studies related to educational or training programs
4. Studies related to the relative efficiency of listening and reading
5. Studies related to aural study systems for the visually handicapped
6. Surveys related to the aural study systems studies

Several conclusions can be drawn from these studies. Probably the three most apparent conclusions are that:

(1) Research related to listening for the visually handicapped is somewhat limited in scope; (2) almost no research relating to very young visually handicapped students has been conducted - the majority of research reported was conducted with students from grades 4-12; and (3) few studies related to partially seeing students have been conducted. These facts would seem to indicate that further research is needed in listening for the visually handicapped, particularly with young children and with partially seeing students.

Other findings revealed that students were able to learn through listening in all instances. In general, there was no difference in listening comprehension and in comprehension when materials were read in braille or print. However, when the efficiency of each of these methods was compared, it was apparent that listening was a decidedly superior method of learning at all levels. But, there was also strong evidence to support the fact that listening was a superior method of learning only when listening ability exceeded print or braille reading ability. That is, students who had not achieved proficiency in braille or print reading actually learned more through listening while students who were proficient braille or print readers learned the same through listening and reading.

These findings are related only to learning, however. The efficiency of learning through listening is still greatly superior to that of reading either braille or print in terms of the time required for each.

Reports of studies related to training programs, or manuals, in listening for the visually handicapped were extremely scarce. One program for primary students was developed, but was relevant only to the particular school in which it was developed. Another rather extensive manual was developed in a rehabilitation center and is appropriate only for students at the high-school or adult level in its present form. A training program was used effectively with partially seeing students, but no published manual was provided. Based on the findings that students who have not achieved proficiency in print or braille reading learn more through listening, it would seem to be imperative that listening programs designed to develop listening skills be developed and that training in this area be provided at a very early age in the education of visually handicapped children.

Extensive studies were conducted in Listening and Reading in Learning by the Blind at the American Printing House for the Blind. These studies led to subsequent studies which resulted in the development of an Aural Study System for the Visually Handicapped. The system consists of a specially designed record format, a specially designed record player, and complementary written materials. This system is now undergoing final development and evaluation. Studies related to the development of the system substantiated findings of earlier research in terms of the correlation between IQ and listening comprehension, the increase of listening comprehension with grade level, and the attainment of higher comprehension scores by braille readers than by print readers. Additional findings dealt with repeated listening to the same materials, constant study time, distributed and massed listening, message length, prior frame of reference, and listening of low ability students. Results showed that repeated listening to the same material improved learning only for high school students, holding study time constant resulted in no significant difference in learning between reading and listening, distributed listening resulted in superior learning for elementary students only, message length and prior frame of reference made no difference in learning, and listening was superior for low ability visually handicapped children only when braille reading comprehension is poor. These findings have important implications for the development of listening skills in visually handicapped students in addition to their contribution to the development of the Aural Study System. However, there were no studies using subjects below the fourth grade level.

Recommendations

In view of the findings summarized above, the following recommendations are made:

1. Research should be extended downward to involve students at lower grade levels - at least grades one, two, and three. Perhaps some of the studies could be replicated, using simpler materials, with young children.
2. Additional studies involving partially seeing students at all grade levels should be conducted.
3. Strong consideration should be given to the development of a training program in listening, perhaps in the form of a manual of instructions, for young visually handicapped children, even at the preschool and primary levels. It might be possible to adopt one of the existing manuals, such as the one from the Kansas Project, or it might be necessary to develop a new program.
4. It seems imperative that consideration be given to beginning training in listening at a very early age with concommitant training in the integration of braille and print reading with listening.

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